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WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE  
GUNNER'S QUADRANTS  
M1 AND M1918

16 AUGUST 1943

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TECHNICAL MANUAL  
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WAR DEPARTMENT  
Washington, 16 August 1943

# ORDNANCE MAINTENANCE

## GUNNER'S QUADRANTS M1 AND M1918

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\*Includes all information contained in Ordnance School Text OS 9-28, Quadrant, gunner's, M1, dated November 1941.

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M1 AND M1918

## Section I

## INTRODUCTION

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## 1. SCOPE.

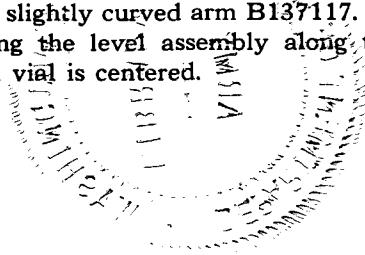
a. This manual is published for the information and guidance of the ordnance personnel. It contains detailed instructions for inspection, disassembly, maintenance, and repair of the Gunner's Quadrant M1 and Gunner's Quadrant M1918 supplementary to those in the Field Manuals and Technical Manuals prepared for the using arms. Additional descriptive matter and illustrations are included to aid in providing a complete working knowledge of the materiel.

## 2. CHARACTERISTICS.

a. The gunner's quadrant is a portable precision instrument used for measuring the elevation or depression angles of guns and howitzers. It is also used for checking the adjustments of elevation devices on sighting equipment furnished with gun and howitzer carriages.

## 3. DIFFERENCES IN MODELS.

a. This Technical Manual covers the maintenance of two types of gunner's quadrants, the M1 (fig. 1) and the M1918 (fig. 2). The principal difference in these instruments is in the design and operation of their movable arms. The Gunner's Quadrant M1 employs a level holder C44899 with a micrometer to obtain fine readings. The Gunner's Quadrant M1918 employs a sliding level assembly mounted on a slightly curved arm B137117. The fine readings are obtained by sliding the level assembly along the arm until the bubble in the level vial is centered.



## INTRODUCTION

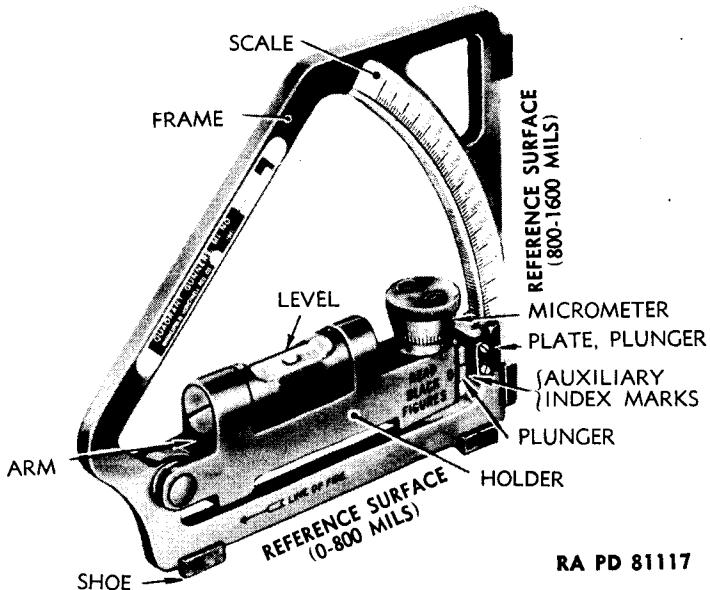


Figure 1—Gunner's Quadrant M1

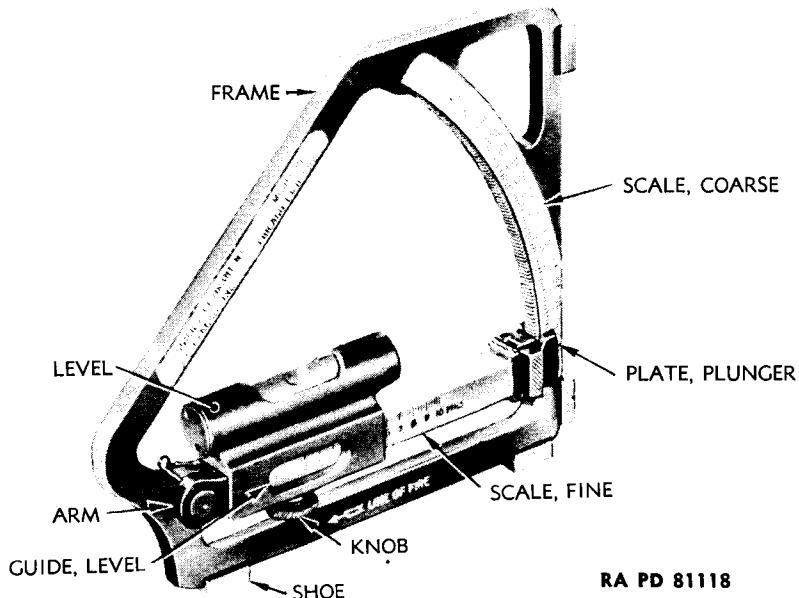


Figure 2—Gunner's Quadrant M1918

**ORDNANCE MAINTENANCE—GUNNER'S QUADRANTS**  
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**Section II**

**DESCRIPTION**

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**4. DESCRIPTION OF GUNNER'S QUADRANT M1 (fig. 1).**

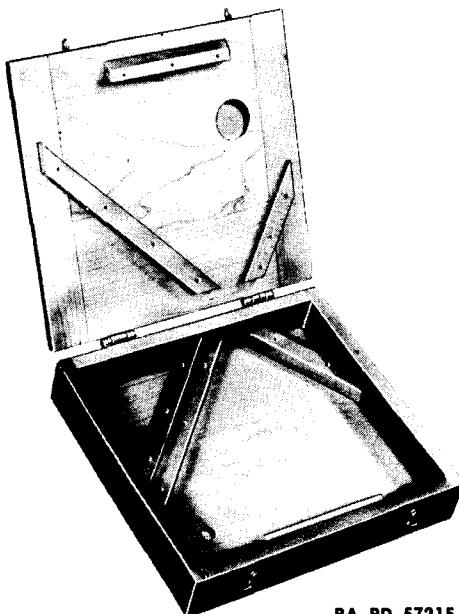
a. This quadrant consists of a sector-shaped frame to which is pivoted an arm and a level holder. Accurately machined teeth on the inside sector of the frame engaging with a spring-loaded, toothed plunger in the arm permit rapid setting of the arm in 10-mil steps to the desired angle as indicated on the coarse scale. Calibrated scales are provided on each side of the frame. The left scale is used for elevations from 0 to 800 mils, and the right scale for elevations from 800 to 1,600 mils. Four steel shoes are screwed to the frame to furnish two sets of true hard surfaces upon which the instrument is placed when taking readings. A name plate riveted to the left side of the quadrant frame furnishes the serial number, model number, manufacturer's name, and date of manufacture. An arrow, along with the instructions "LINE OF FIRE," is scribed on each side of the frame to indicate the direction the instrument is to be faced when taking readings.

b. The arm and level holder assembly are designed to take fine readings which supplement the coarse scale reading. The level vial is mounted in the level tube and secured to the level holder with four headless cone point screws. These screws permit adjustments to the level vial. A micrometer mounted on the plunger end of the level holder is used in obtaining fine readings. The micrometer has red and black figures scribed on it; the black figures are used when taking readings on the 0- to 800-mil scale, while the red figures are used when taking readings on the 800- to 1,600-mil scale. The micrometer is graduated in 0.2-mil steps.

**5. DESCRIPTION OF GUNNER'S QUADRANT M1918 (fig. 2).**

a. The Gunner's Quadrant M1918 is similar to the Gunner's Quadrant M1. The frame is identical while the arm assembly is of a different construction. On this unit, the level vial is secured to a support screwed to a guide which slides on a slightly curved arm. Each side of the arm is calibrated in 0.2-mil steps.

**DESCRIPTION**



RA PD 57215

**Figure 3—Packing Chest for Gunner's Quadrant**

**6. PACKING CHEST FOR GUNNER'S QUADRANT (fig. 3).**

a. A wooden packing chest is provided with each gunner's quadrant. A leather carrying case is provided with the later Gunner's Quadrant M1 instead of the packing chest. The chest contains special blockings to prevent shifting of the instrument when placed therein. The carrying case is complete with neck strap and is designed to accommodate the instrument.

**7. OPERATION.**

a. Instructions for operating Gunner's Quadrants M1 and M1918 can be found in 100-series Technical Manuals pertaining to field artillery equipment such as TM 9-330.

**ORDNANCE MAINTENANCE—GUNNER'S QUADRANTS  
M1 AND M1918****Section III****CARE AND PRESERVATION**

Paragraph

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**8. GENERAL.**

a. **Care in Handling.** These instruments will stand the normal wear to which they are subjected, but care must be taken to prevent any unnecessary rough treatment that might cause the level vial to be broken, or the parts to be strained out of line. To prevent unnecessary wear and damage to the teeth, keep the teeth of the spring-loaded plunger clear of the teeth on the frame when moving the arm into position on the elevation scale. The instruments should be kept in their chests or cases when not in use. Daily, while in use, before returning the instruments to their chests or cases, thoroughly clean with a dry, clean lintless CLOTH, wiping. Apply a thin film of OIL, lubricating, for aircraft instruments and machine guns, to their shoe surfaces with a lightly oiled wiping cloth. Keep the level vial of the Gunner's Quadrant M1 covered when not in use. Keep the packing chests in good condition with the hinges, hooks, and block properly secured. The carrying case must be kept in good condition with the leather, fastener, and riveting in proper repair. The leather is kept pliable by an application of OIL, neat's foot, whenever required.

b. **Lubrication.** Daily, while in use, apply one or two drops of OIL, lubricating, for aircraft instruments and machine guns, to the pivots and the plunger of the instruments. Wipe off all excess lubricant with a dry, clean wiping cloth to prevent accumulation of dust and grit.

Section IV  
INSPECTION

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**9. PURPOSE.**

- a. Inspection is vital. Thorough, systematic inspection at regular intervals is the best insurance against an unexpected failure of the instrument at the critical moment when maximum performance is absolutely necessary.
- b. Inspection is for the purpose of determining the condition of the instrument, whether repairs or adjustments are required, and the action necessary to place the instrument in serviceable condition.
- c. The basic inspections are made to determine the condition of the instrument and to locate the faults. Proper disposition of the instrument can then be made and necessary action taken or recommended. Inspection forms are provided for recording the results of the inspection.
- d. The detailed inspection and correction described in the maintenance and repair section of the manual is performed by the instrument repairman. Following these instructions, he puts the instrument in serviceable condition. The procedure may vary with each instrument, depending on the faults indicated by the basic inspection. Inspection forms and methods used in connection with the detailed inspection are described in TM 9-2602, "Instruction Guide, The Instrument Repairman."

**10. TOLERANCES.**

- a. Tolerances, or allowable errors, are specified when necessary to indicate the degree of accuracy in performing certain adjustments. In general, an instrument is considered unserviceable if the error in any part exceeds the specified tolerance. However, it must be realized that the specified tolerance is intended to serve mainly as a guide for the inspector, and must be supplemented by the inspector's judgment. Even if the tolerances are within satisfactory limits, the repairman should attempt to reduce them if time and conditions permit.

**ORDNANCE MAINTENANCE—GUNNER'S QUADRANTS  
M1 AND M1918****11. INSPECTION REQUIREMENTS.**

- a. The gunner's quadrant should be checked for:
  - (1) Name plate data.
  - (2) Appearance.
  - (3) Completeness.
  - (4) Condition of paint.
  - (5) Damaged parts.
  - (6) Smoothness of operation.
  - (7) Worn parts.
  - (8) Accuracy in operation.

**12. FACILITIES NEEDED FOR INSPECTION.**

- a. To facilitate the inspection of the instrument the following equipment should be available:

BENCH, sturdy work

LEVEL, master

IRON, universal right angle (fig. 4)

PLATE, surface

**13. BASIC INSPECTION.****a. Preliminary Inspection.**

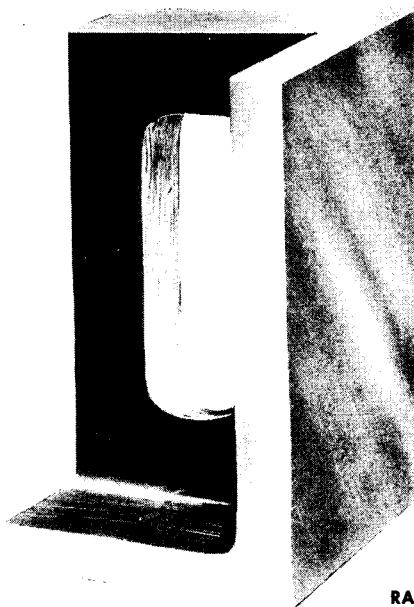
- (1) Record the serial number from the name plate.
- (2) Examine the instrument for completeness, appearance, condition of paint, and for broken parts.
- (3) Check to see that all screws are properly sealed and the level vial is properly secured to its holder.
- (4) Examine the condition of the four shoes. The shoes must not be burred or mis-shaped. Place the instrument on a leveled surface plate so that it rests on the two shoes on the 0- to 800-mil reference surface. The instrument must rest on sufficient point of contact on each shoe so that it does not rock or lean to either side of the vertical plane. Check the two remaining shoes.
- (5) Check the operation of the arm and plunger. There should be no discernible shake in the pivot bearing and the plunger bearing. The arm and plunger must function without noticeable binding. The arm and plunger springs must have sufficient pressure to hold the arm and plunger rigidly in their positions. The teeth on the plunger and frame must be clean and not damaged.

- (6) Check the operation of the micrometer on the Gunner's Quadrant M1. It must operate up and down its full scale without noticeable binding and unnecessary looseness.

- (7) Examine the operation of the slide of the Gunner's Quadrant M1918. The slide should travel across the scaled portion of the arm without binding, and the clamping screw should function properly to lock the slide in any desired position.

- b. Accuracy Test, Gunner's Quadrant M1.** Set the plunger plate against 0 on the elevation scale. Reading the black figures, match

## INSPECTION



RA PD 81119

**Figure 4—Universal Right Angle Iron**

the auxiliary index marks of the arm and the level holder, and set the micrometer black zero against its index. Place the instrument on a leveled surface plate so that it rests on the two shoes forming the 0- to 800-mil reference surface. The bubble in the level vial must indicate a level reading within  $\pm 0.4$ -mil movement of the micrometer. With the black zero of the micrometer against its index, check for 10-mil movement of the micrometer. Set the plunger plate against the 1,600 on the elevation scale. Reading the red figures, match the auxiliary index marks of the arm and the level holder and set the red zero of the micrometer against its index. Hold the instrument with the two shoes that support it on the 800- to 1,600-mil reference surface against the vertical surface of a universal right angle iron placed on a leveled surface plate. The bubble in the level vial must indicate a level position within  $\pm 0.4$ -mil movement of the micrometer.

c. **Accuracy Test, Gunner's Quadrant M1918.** Set the plunger plate against 0 on the elevation scale. Slide the level sliding assembly to 0 on the 0- to 800-mil scale side of the arm. Place the instrument on a leveled surface plate so that it rests on the two shoes forming the 0- to 800-mil reference surface. The bubble in the level vial must be centered within  $\pm 0.4$ -mil movement of the level

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sliding assembly. Set the plunger plate against the 1,600 on the elevation scale. Slide the level sliding assembly to 0 on the 800- to 1,600-mil scale side of the arm. Hold the instrument, with the two shoes that support it, on the 800- to 1,600-mil reference surface against the vertical surface of a universal right angle iron placed on a leveled surface plate. The bubble in the level vial must be centered within  $\pm$  0.4-mil movement of the sliding assembly.

## Section V

## MAINTENANCE AND REPAIR

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Shoe adjustments, gunner's quadrants M1 and M1918 .....	16
Level vial adjustments, gunner's quadrant M1 .....	17
Level vial adjustments, gunner's quadrant M1918 .....	18

## 14. GENERAL.

a. The using arms are prohibited from attempting any adjustments or making any repairs to the instrument. Corrections for defects of the gunner's quadrant consist of replacement of broken or worn parts and necessary adjustments to make the instrument accurate. These operations can generally be performed by the instrument section in the field. If the facilities of the section do not permit satisfactory completion of the adjustment or repair, the unserviceable instrument will be passed on to a higher maintenance echelon.

b. Equipment needed for the repair and maintenance of the instruments:

FILE, flat	PUNCH, drive pin, 0.050-in. pt
GYPSUM, calcined, grade 1, fine	SCREWDRIVER, 4-in. blade
HAMMER, ball-peen, 4-oz	SCREWDRIVER, jeweler's, 0.055-in. wide blade
HAMMER, brass, 3-oz	WRENCH, teat, adjustable
PUNCH, drive pin, $\frac{3}{16}$ -in. pt	

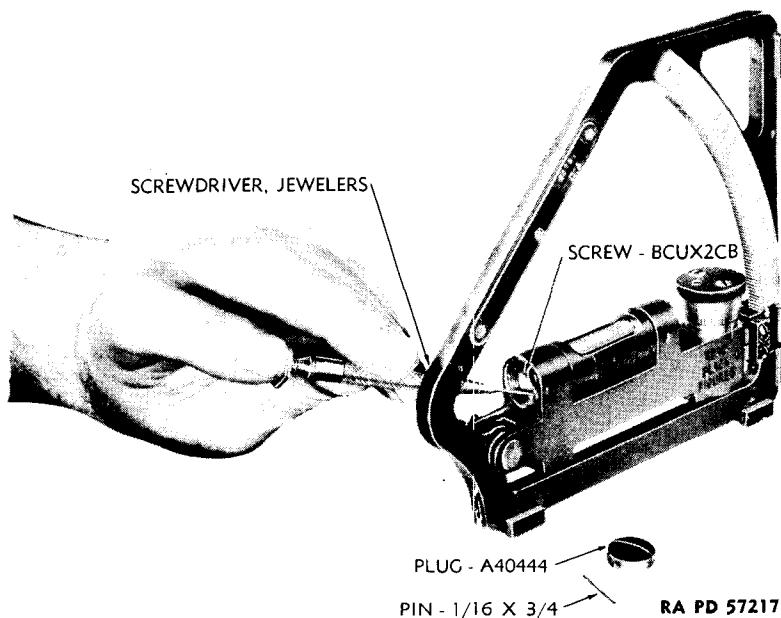
## 15. DETAILED INSPECTION AND CORRECTION OF GUNNER'S QUADRANTS M1 AND M1918.

a. The repairman will use only the instructions that are necessitated by the results of a preliminary visual inspection or an accuracy test. Detailed information on the method of replacing damaged or worn parts is furnished in section VI.

## 16. SHOE ADJUSTMENTS, GUNNER'S QUADRANTS M1 AND M1918.

a. Check the condition of the four shoes. When practicable, remove any burs with a flat fine stone in order to maintain a smooth surface. Replace all mis-shaped shoes. Make sure the screws securing the shoes in position are tight. Place the instrument on a leveled surface plate so that it rests on the two shoes corresponding to the 0- to 800-mil scale reference surface. The instrument should rest on sufficient point of contact on each shoe so that it does not rock.

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**Figure 5—Gunner's Quadrant M1—Adjusting Level Vial**

or lean to either side of the vertical plane. If rocking or insufficient point of contact exists, interchange shoes until this condition is reduced to a minimum. To facilitate finding high spots on shoes, wipe a thin coat of PRUSSIAN BLUE, paste in oil, on the surface plate. Place instrument with shoes to be checked on a surface plate, and with slight pressure move the instrument across the surface plate approximately 1 inch. On inspection, the shoe surface contact will be shown by the amount of Prussian blue on the shoes. The points not showing blue must be shimmed until the whole shoe surface contains Prussian blue. Use the same method on the other two shoes.

**17. LEVEL VIAL ADJUSTMENTS, GUNNER'S QUADRANT M1.**

- a. Set the plunger plate at 0 on the elevation scale. Bring the zero of the black scale on the micrometer and its index in coincidence. The auxiliary index marks on the arm and the holder should be in coincidence. If this is not the case, set these index marks in coincidence, loosen the two screws on the top of the micrometer knob, and turn the micrometer scale to bring the zero of the black scale and its index in coincidence. Tighten the two screws on top of the micrometer knob. After this has been done, place the instrument on a leveled surface plate so that it rests on the two shoes forming the 0- to 800-mil reference surface. The bubble in the vial should be centered.

## MAINTENANCE AND REPAIR

To center the bubble, remove the level vial tube plug from the end of the level holder. This plug is held in its seat by a pin which may be driven out from the left side. After removing the plug, four headless cone point screws are visible which are used to adjust the vial to a level position. To raise the vial at the plug end of the holder, loosen the two side screws, back off on the top screw, and turn in on bottom screw (fig. 5). To lower vial at plug end of holder, loosen the two side screws, back off on the bottom screw, and turn in on top screw. After making adjustments, be sure the screws are all seated snugly. Replace and lock level vial tube plug in position with pin. After this has been accomplished, the vertical plane should be checked. Set the plunger plate at 1,600 on the elevation scale and the red zero of the micrometer and its index in coincidence with the red auxiliary index marks in coincidence. Hold the instrument with the two shoes that support it on the 800- to 1,600-mil reference surface against the vertical surface of a universal right angle iron (fig. 4) placed on a leveled surface plate. If the bubble in the vial is not centered, correct by shimming the shoe that is low.

### 18. LEVEL VIAL ADJUSTMENTS, GUNNER'S QUADRANT M1918.

- a. Set the plunger plate at 0 on the elevation scale. Facing the 0- to 800-mil scale bring the index of the vial tube guide to the zero setting of the arm. Place the instrument on a leveled surface plate so that it rests on the two shoes forming the 0- to 800-mil reference surface. The bubble in the vial must be centered. If the bubble is not centered, correct by shimming the shoe that is low. After this adjustment is accomplished, the vertical plane should be checked. Set the plunger plate at 1,600 on the elevation scale. Facing the 800- to 1,600-mil scale, bring the index of the vial tube guide to the zero setting of the arm. Hold the instrument with the two shoes that support it on the 800- to 1,600-mil reference surface against the vertical surface of a universal right angle iron (fig. 4) placed on a leveled surface plate. If the bubble in the vial is not centered, correct by shimming the shoe that is low.

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**Section VI**

**DISASSEMBLY AND ASSEMBLY**

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Disassembly of gunner's quadrant M1	21
Assembly of gunner's quadrant M1	22
Disassembly of gunner's quadrant M1918	23
Assembly of gunner's quadrant M1918	24

**19. GENERAL.**

a. No one but experienced ordnance personnel is permitted to disassemble these instruments. The disassembly is to be made only when necessary to replace faulty parts or make adjustments. The instruments should be disassembled only as far as is absolutely necessary to replace the faulty parts. Care should be taken that the proper tools are used when making repairs. Indicating scribe marks made before removing parts will facilitate proper reassembly. Before attempting any repairs to the instrument, check that the proper facilities, such as material and tools, are available. All parts must be thoroughly cleaned with SOLVENT, dry-cleaning, and carefully inspected before proceeding with their reassembly. All bare metal surfaces must be immediately coated with a thin film of OIL, lubricating, for aircraft instruments and machine guns, before handling in order to avoid rusting. NOTE: In order to simplify describing disassembly and assembly operations, the name plate side will be designated as the front of the instrument.

**20. SEALING.**

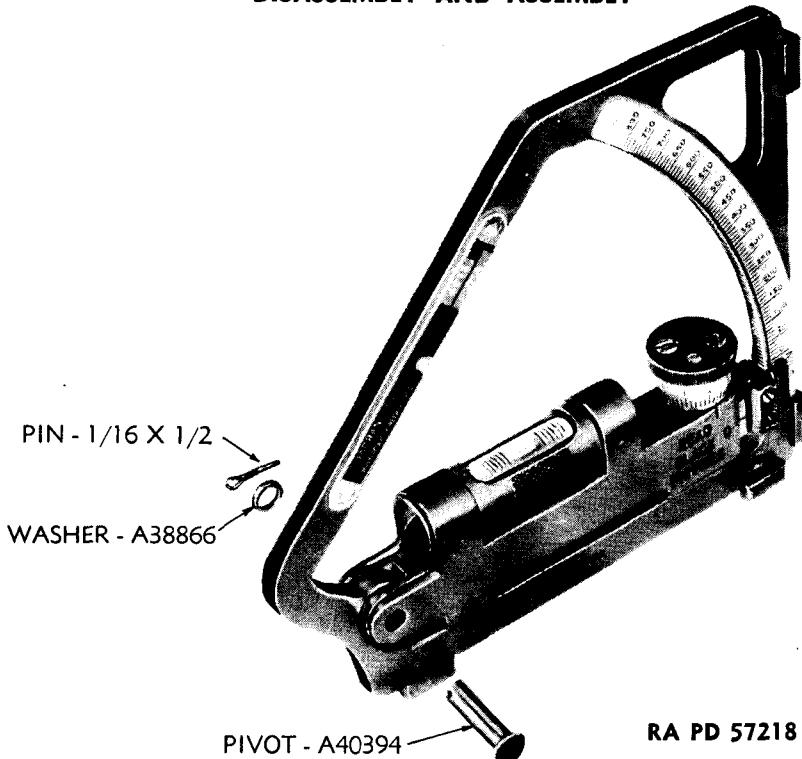
a. After instrument has been assembled and given a final check, all screws should be set in VARNISH, shellac. To do this, the screws should be run down in position, then backed off enough to allow a small brush to be placed under the head with a thin coat of shellac varnish and the screws brought back in their seat tightly enough to cause them to become sealed.

b. Recesses of all external screws and pins should be plugged with CEMENT, plugging, and then be painted over to prevent the using arms from moving them, thus causing the instrument to get out of adjustment. For instructions on painting see section VII.

**21. DISASSEMBLY OF GUNNER'S QUADRANT M1.**

a. The complete disassembly operation is listed below, but only

## DISASSEMBLY AND ASSEMBLY



**Figure 6—Gunner's Quadrant M1—Pivot Removed**

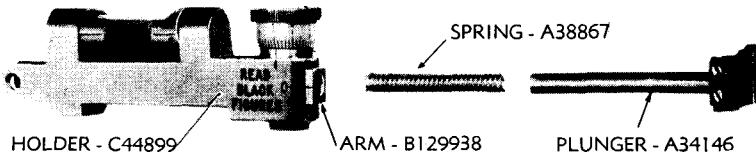
steps important to the replacement of the faulty parts should be followed.

**(1) REMOVE LEVER HOLDER AND ARM.**

(a) Remove the cotter pin from the pivot on the back side of the instrument and remove the brass washer (fig. 6).

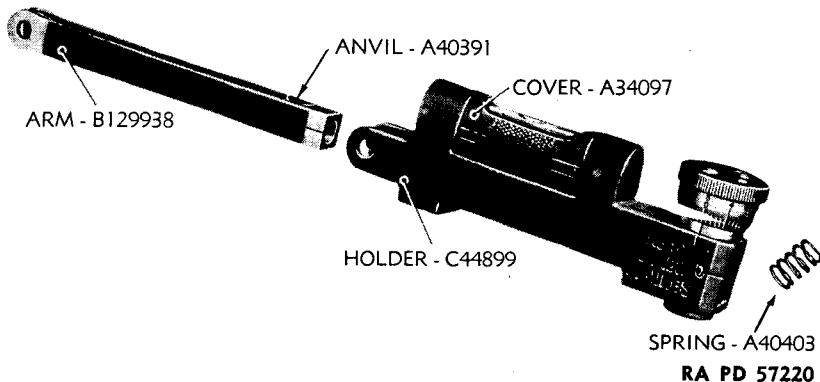
(b) Drive the pivot from the arm, level holder, and frame.

(c) Set the plunger plate at zero. Disengage the plunger from the notches on the frame; then raise the pivot hole end of level holder and arm out of position, and remove the level holder and arm as an assembly. NOTE: As the plunger is loose in the end of the arm, care must be taken to prevent it from falling on the floor.



**Figure 7—Gunner's Quadrant M1—Plunger and Plunger Spring Removed**

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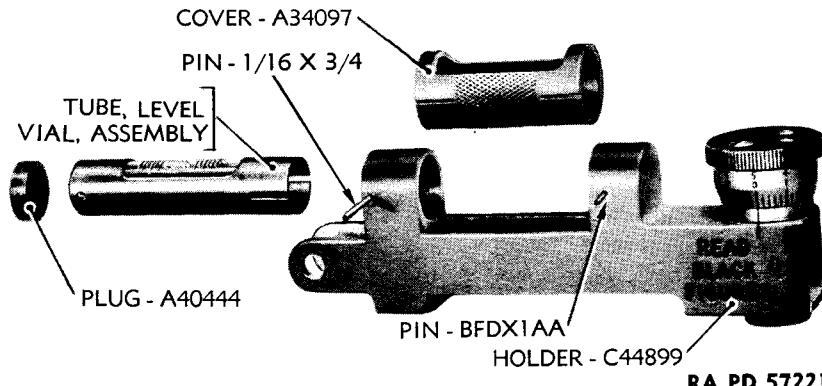


**Figure 8—Gunner's Quadrant M1—Arm and Compression Spring Removed**

- (2) REMOVE PLUNGER FROM ARM (fig. 7). Slide out plunger and plunger spring from arm.
- (3) REMOVE ARM FROM LEVEL HOLDER (fig. 8).
  - (a) Push arm through level holder from micrometer end, and lift out.
  - (b) Lift out compression spring.
  - (4) REMOVE LEVEL VIAL (fig. 9).
    - (a) Locate and drive out pin at vial tube plug end of level holder.

NOTE: Pin opposite the plug in level holder must not be disturbed unless it is loose, and then it should be replaced.

- (b) Unscrew vial tube plug from level holder.
- (c) Remove four headless cone point adjusting screws, and pry out level vial tube through level cover.



**Figure 9—Gunner's Quadrant M1—Vial Tube Removed from Holder**

## DISASSEMBLY AND ASSEMBLY



TUBE - A40402

VIAL - A31316  
RA PD 57222**Figure 10—Gunner's Quadrant M1—Level Vial Removed from Tube**

(d) Lift off level cover.  
 (e) Extreme care must be exercised in removing the level vial from the tube. The gypsum must be dug out very slowly and carefully. Avoid breaking the level vial tip off. Never cross the center of the gypsum; always dig around the edge nearest the tube. Use shim stock to dig out the remaining gypsum between the level vial and the tube. After all of the gypsum has been removed, push the level vial out of the tube (fig. 10).

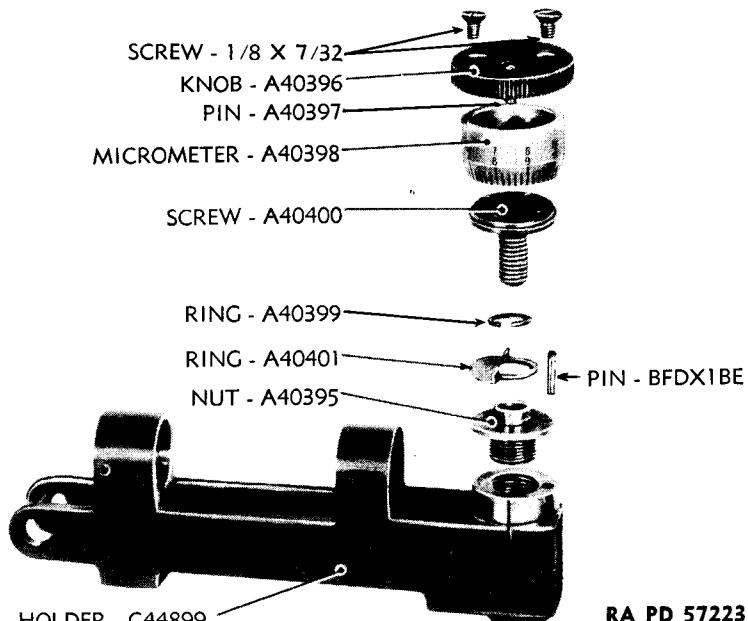
## (5) REMOVE MICROMETER GROUP (fig. 11).

(a) Unscrew two screws from the micrometer knob, and lift off knob and micrometer scale.

(b) Unscrew and remove the micrometer knob screw.

(c) Gently pry off the split ring from the top of the micrometer screw nut, and lift off micrometer stop ring.

(d) Drive micrometer nut pin through and out of level holder.



RA PD 57223

**Figure 11—Gunner's Quadrant M1—Micrometer Removed**

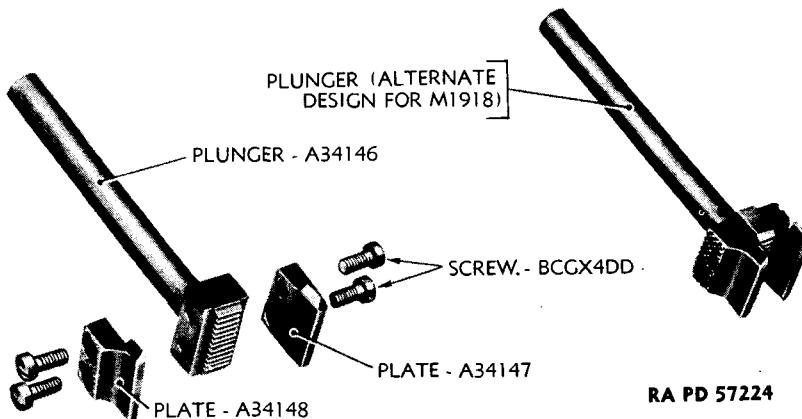
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Figure 12—Gunner's Quadrants M1 and M1918—Plungers

- (e) Unscrew micrometer screw nut from level holder.
- (6) DISASSEMBLE PLUNGER ASSEMBLY (fig. 12). Remove the four screws holding the two plates to the end of plunger, and remove plates. Scribe mark the plates so that they will be properly replaced.
- (7) REMOVE SHOES FROM FRAME (fig. 13). Remove the screws securing the shoes to frame, and tap off shoes with a brass hammer.

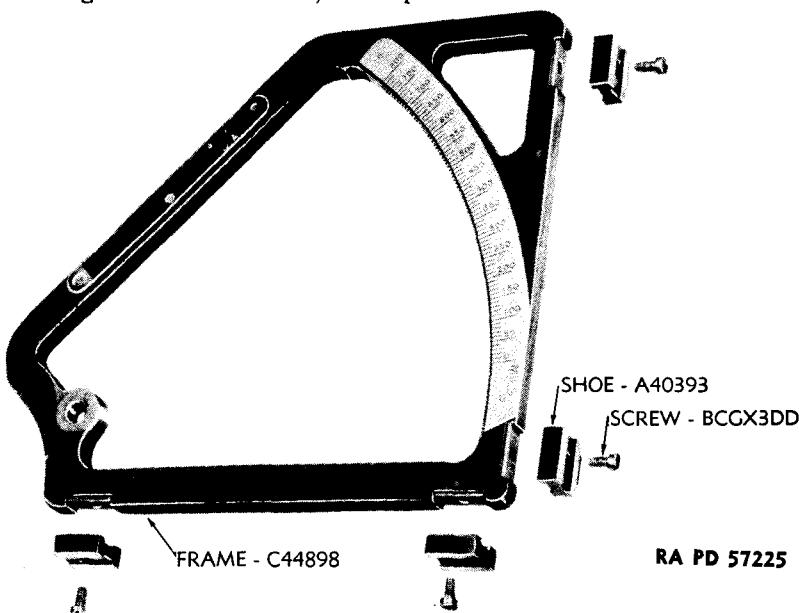


Figure 13—Gunner's Quadrants M1 and M1918—Frame with Shoes Removed

## DISASSEMBLY AND ASSEMBLY

### 22. ASSEMBLY OF GUNNER'S QUADRANT M1.

a. **Install Shoes to Frame** (fig. 13). Place shoes in position on frame, and secure with screws. Refer to paragraph 16 for adjustment of shoes.

b. **Assemble Plunger Assembly** (fig. 12). Secure the two plunger plates in their proper places on end of plunger assembly with four screws.

c. **Install Micrometer Group** (fig. 11).

(1) Thread micrometer screw nut in position on level holder until the nut is tight and the pin holes are lined up.

(2) From the top of the level holder, drive pin BFDX1BE in position in lined up holes until  $\frac{1}{16}$  inch extends from top of micrometer screw nut.

(3) Place micrometer stop ring with lips upward on micrometer screw nut, and lock in position with split ring.

(4) Apply one or two drops of OIL, lubricating, for aircraft instruments and machine guns, to the micrometer screw, and thread micrometer screw through micrometer screw nut until the black auxiliary index marks of the arm and holder are in line.

(5) Facing the black graduation side of the instrument, turn the stop ring so that the solid part of the ring is toward the black index and its lip hits the pin BFDX1BE.

(6) Select the hole on micrometer screw nearest the level vial, and turn micrometer screw (not more than one-eighth turn) until this hole and the hole directly opposite it are in a straight line with the level vial.

(7) Place micrometer A40398 and knob A40396 in position over micrometer screw A40400 so that pin A40397 in knob enters the hole nearest the level vial.

(8) Secure micrometer and knob in position with two screws.  
NOTE: Final adjustment of micrometer will be made after the gunner's quadrant is completely assembled.

d. **Install Level Vial** (fig. 9 and fig. 10).

(1) Thoroughly clean out level vial tube.

(2) Place level vial tube on flat leveled surface.

(3) Push level vial into position in level vial tube and shim with paper of desired thickness to secure level vial in leveled position.

(4) Set level vial in level vial tube with GYPSUM, calcined, Grade I, fine, mixed with water to form paste, and allow gypsum to dry.

(5) Hold level vial cover in position over level holder with the small projection on the inside of the cover toward the micrometer.

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**ORDNANCE MAINTENANCE—GUNNER'S QUADRANTS  
M1 AND M1918**

(6) Push level tube assembly, slotted end first, into level holder and through level vial cover. Align slot in level tube with pin BFDX1AA in level holder and continue to push level tube in until it is seated.

(7) Insert the four headless cone point adjusting screws. NOTE: These screws are used in making the final adjustments of the level vial, and should not be tightened at this time. Plug at the end of the level holder is to be installed after the final level vial adjustment has been made.

**e. Install Arm in Level Holder (fig. 8).**

(1) Insert compression spring in position below micrometer.

(2) Push arm with arm anvil facing up, through level holder at the pivot end, and continue pushing arm until pivot holes in arm line up with pivot holes in level holder.

**f. Install Plunger in Arm (fig. 7).**

(1) Drop plunger spring into arm.

(2) Coat the plunger stem with a thin film of OIL, lubricating, for aircraft instruments and machine guns, and place plunger stem into arm.

**g. Install Arm and Level Holder in Frame (fig. 6).**

(1) Turn plunger in arm so that beveled plunger plate edges face upward.

(2) With plunger, compress the plunger spring and arm about zero on the elevation scale. Push level holder and arm into position over frame. Do not release plunger until all pivot holes are lined up.

(3) Apply one or more drops of OIL, lubricating, for aircraft instruments and machine guns, to pivot and drive pivot through holes from front of quadrant.

(4) Place brass washer over pivot in back of quadrant and secure pivot with cotter pin.

**h. Install Level Holder Plug.** NOTE: Level vial tube plug should be installed only after level vial has been adjusted. See paragraph 17 for level vial adjustment.

(1) Screw level vial tube plug in until pinhole in plug is in line with the holes in the level holder.

(2) Drive pin through level holder and level vial tube plug, and secure.

**23. DISASSEMBLY OF GUNNER'S QUADRANT M1918.**

**a. Remove Arm (fig. 14).**

(1) Remove the cotter pin from the pivot on the right or rear side of the instrument, and remove brass washer.

## DISASSEMBLY AND ASSEMBLY

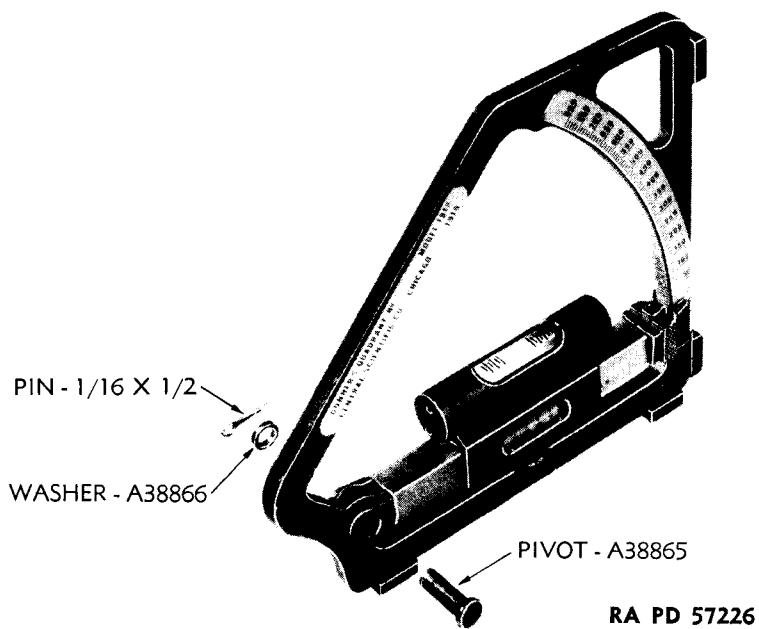


Figure 14—Gunner's Quadrant M1918—Pivot Removed

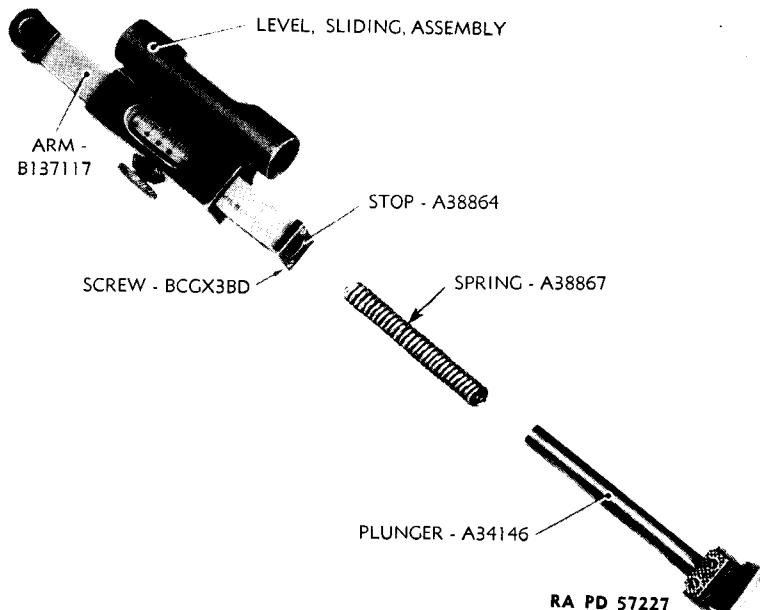
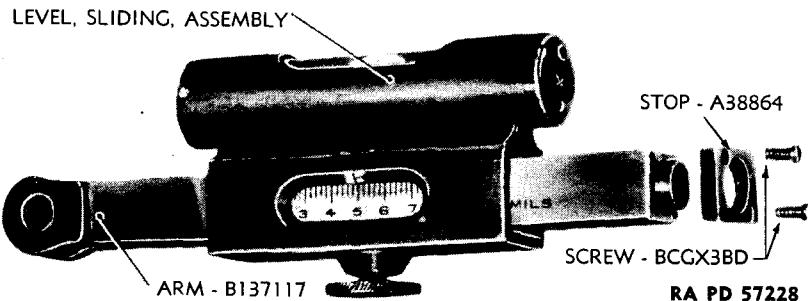


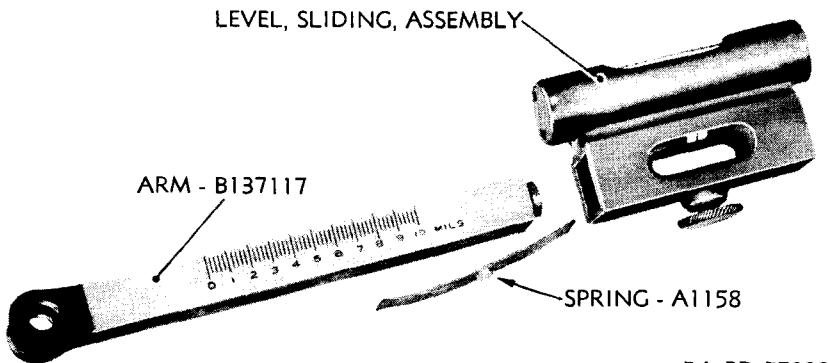
Figure 15—Gunner's Quadrant M1918—Plunger and Plunger Spring Removed

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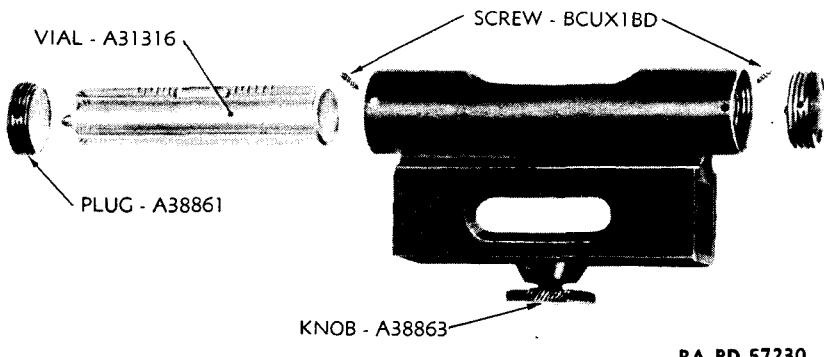
**Figure 16—Gunner's Quadrant M1918—Sliding Level Stop Removed**

- (2) Drive the pivot from the arm and frame assembly.
- (3) Set the arm at zero reading on the elevation scale, raise the pivot hole end of arm out of position, and lift out arm and plunger as an assembly.
- b. Remove Plunger (fig. 15). Lift plunger out of arm, and allow plunger spring to drop out. NOTE: On some plunger assemblies, the plunger plates on the end are secured with screws and can be removed, while other plungers are manufactured in one piece.
- c. Remove Sliding Level Assembly (figs. 16 and 17).
  - (1) Remove two screws securing sliding level stop to arm, and lift off stop.
  - (2) Loosen sliding level assembly by turning back on level clamping screw thumb knob, and remove sliding level assembly from arm.
  - (3) Lift level spring assembly out of sliding level guide.



**Figure 17—Gunner's Quadrant M1918—Arm Removed from Sliding Level Guide**

## DISASSEMBLY AND ASSEMBLY



**Figure 18—Gunner's Quadrant M1918—Level Vial Removed**

**d. Remove Level Vial (fig. 18).**

(1) Remove the two screws securing the level vial plugs at each end of the level vial tube.

(2) Unscrew and remove the level vial plugs at each end of the level vial tube.

(3) Clean the gypsum from the level vial tube XH3A, and remove the level vial A31316. Refer to paragraph 21 a (4) (e).

**e. Remove Level Clamping Screw and Knob.**

(1) File the portion of the leveling clamp screw riveted to the clamping screw knob in order to free knob.

(2) Drive clamping screw knob from clamping screw, and remove screw through the inside of level guide.

**f. Remove Shoes from Frame (fig. 13).** Remove the screws securing shoes to frame assembly, and tap off shoes with 3-ounce brass hammer.

## 24. ASSEMBLY OF GUNNER'S QUADRANT M1918.

**a. Install Shoes to Frame (fig. 13).** Place shoes in position on frame, and secure with screws. See shoe adjustment paragraph 16.

**b. Install Level Clamping Screw and Knob.**

(1) From inside of level guide, insert level clamping screw.

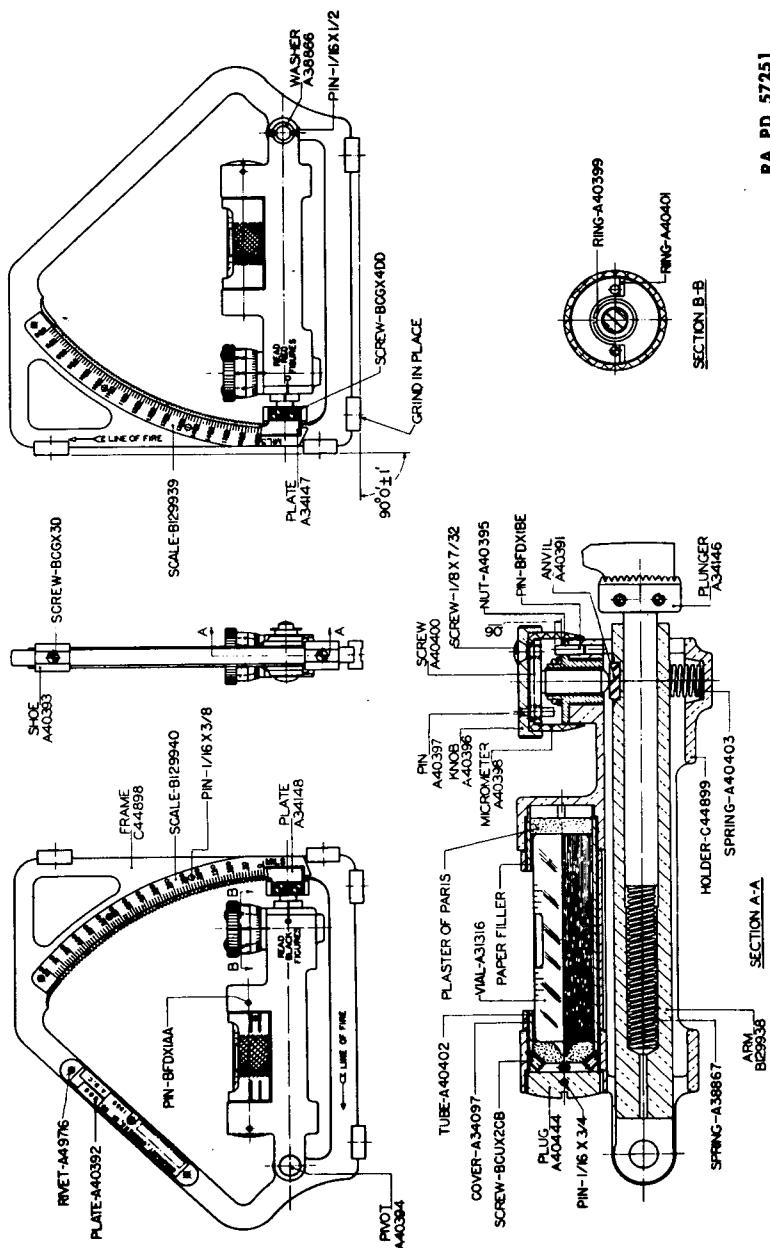
(2) Place clamping screw knob over end of clamping screw so that screw end extends through hole and out of the flat surface of the knob.

(3) Place the assembly on a solid support, and rivet clamping screw end to clamping screw knob.

**c. Install Sliding Level Assembly (figs. 16 and 17).**

(1) Turn knob until level clamping screw is backed down.

## **ORDNANCE MAINTENANCE—GUNNER'S QUADRANTS M1 AND M1918**



**Figure 19—Gunner's Quadrant Mi—Assembled and Sectioned Views**

## DISASSEMBLY AND ASSEMBLY

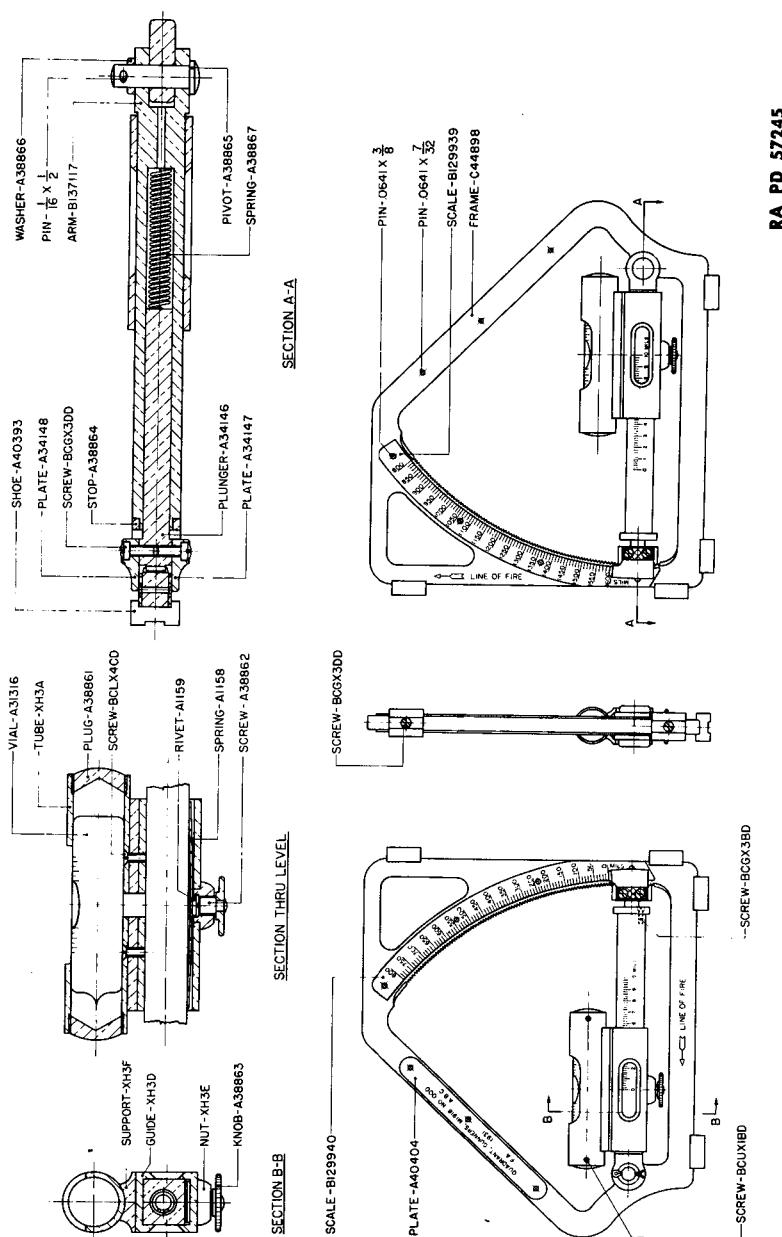


Figure 20—Gunner's Quadrant M1918—Assembled and Sectioned Views

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- (2) Insert level spring, with rivet head down, over clamping screw-head.
- (3) Holding level spring in position, push arm through level guide.
- (4) Place sliding level stop on end of arm, and secure with two screws.

**d. Install Plunger in Arm (fig. 15).**

- (1) Drop plunger spring into arm.
- (2) Coat plunger stem with a thin film of OIL, lubricating, for aircraft instruments and machine guns, and place plunger stem into arm.

**e. Install Arm (fig. 14).**

- (1) Turn plunger in arm so that the beveled plunger plate edges face upward.
- (2) With plunger, compress plunger spring and arm near zero on elevation scale. Push arm into position over frame. Do not release plunger until pivot holes in arm line up with pivot hole in frame.
- (3) Apply one or two drops of OIL, lubricating, for aircraft instruments and machine guns, to pivot, and drive pivot through holes from the back of the instrument.
- (4) Place brass washer over pivot in front of instrument, and secure pivot with cotter pin.

**f. Install Level Vial (fig. 18).**

- (1) Thoroughly clean vial tube.
- (2) Push vial into vial tube so that the calibrations on the vial are centered in the tube.
- (3) Secure vial in vial tube by means of wedges: four wedges in each end, one on each side, one on the top, and one on the bottom. Set the plunger plate at zero on the elevation scale. Slide the level sliding assembly on the 0- to 800-mil scale of the arm. Place the instrument on a leveled surface plate, and adjust level vial by means of wedges until level vial bubble is centered. Secure the setting by pouring gypsum around the level vial. Allow gypsum to set before replacing screw tube plug.
- (4) Screw level vial tube plugs into each end of level tube until their screw holes line up with the screw holes in the tube.
- (5) Secure level vial tube plugs in position by inserting a screw in each end of tube.

## Section VII

### PAINTING

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#### 25. TOUCH-UP PAINTING.

a. Since these instruments are not subject to hard usage and wear, the painting operation consists mostly in touching up small scratches due to handling and unavoidable blemishes caused by repair and adjustment operations. ENAMEL, synthetic, olive-drab, lusterless, will be used in painting. Care should be taken to prevent the paint from splashing on scales, vial, bearing surfaces, shoe surfaces, teeth on either frame or plunger, or anywhere else causing hindrance to the operation of the instrument. All external screws and pins should be painted over to prevent the using arms from moving them, thus causing instrument to get out of adjustment.

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**Section VIII**

**REFERENCES**

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**26. STANDARD NOMENCLATURE LISTS.**

Cleaning, preserving and lubricating materials; recoil fluids, special oils, and miscellaneous related items . . SNL K-1

Geometrical tools and instruments (squares, compasses, rules, gages, calipers, micrometers, dividers, levels, protractors, scribes, surface plates, etc.) . . . . SNL J-3

Quadrant, gunner's, M1 (mils) (previously, M1919) . . SNL F-140

Quadrant, gunner's, M1918 (mils) . . . . . SNL F-13

Truck, instrument repair, M1 . . . . . SNL G-92

Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained as the "Ordnance Publications for Supply Index" . . . . OPSI

**27. EXPLANATORY PUBLICATIONS.**

Chemical decontamination materials and equipment . . TM 3-220

Cleaning, preserving, lubricating, and welding materials and similar items issued by the Ordnance Department . . TM 9-850

Cold weather lubrication and service of artillery equipment . . . . . OFSB 6-5

Defense against chemical attack . . . . . FM 21-40

Instruction guide: The instrument repair man . . . . . TM 9-2602

Product guide . . . . . OFSB 6-2

Sighting and fire control instruments—lubrication, general . . . . . OFSB 6-9

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M1 AND M1918

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(For explanation of symbols, see FM 21-6)